

NITROGEN ISOTOPIC COMPOSITION OF ORGANIC MATTER IN A PRISTINE COLLECTION IDP.

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Introduction: Anhydrous chondritic porous interplanetary dust particles (CP IDPs) are probable cometary materials that show primitive characteristics, such as unequilibrated mineralogy, fragile structure, and abundant presolar grains and organic matter [1-3]. CP IDPs are richer in aliphatic species and N-bearing aromatic hydrocarbons than meteoritic organics and commonly exhibit highly anomalous H and N isotopic compositions [4,5]. Cometary organic matter is of interest in part because it has escaped the hydrothermal processing experienced by meteorites. However, IDPs are collected using silicone oil that must be removed with strong organic solvents such as hexane. This procedure is likely to have removed some fraction of soluble organic phases in IDPs. We recently reported the first stratospheric collection of IDPs without the use of silicone oil [6]. Here we present initial studies of the carbonaceous material in an IDP from this collection.

Methods: We identified two cluster IDPs (W7262 A2 and A3) on a polyurethane foam collector that have the typical mineralogy of CP IDPs [6]. We imaged both of these IDPs on the collector for native fluorescence by UV microscopy. The structure and distribution of the carbonaceous material in a fragment of IDP A2 was characterized by transmission electron microscopy (TEM). Three microtome sections of this IDP were measured for O and N isotopic compositions by isotopic imaging with the JSC NanoSIMS 50L ion microprobe. Images of ^{16,17,18}O, ¹²C¹⁴N, ¹²C¹⁵N, and ²⁸Si were obtained simultaneously with electron multipliers. Terrestrial San Carlos olivine and 1-hydroxy benzotriazole hydrate were measured as standards.

Results & Discussion: Both A2 and A3 exhibited μm -scale fluorescent regions, with A3 displaying a prominent $\sim 3 \mu\text{m}$ fluorescent hotspot. The fragment of A2 that we examined by TEM was C-rich, with carbonaceous material accounting for roughly half of the sample volume. The carbonaceous material resembles clusters of hollow organic globules or vesicular C with large open areas [7,8]. This material encapsulates the mineral grains and GEMS grains in the IDP. The silicates and GEMS grains had O isotopic compositions within error of terrestrial composition. The carbonaceous material was thoroughly anomalous, with $\delta^{15}\text{N}$ values ranging from 300 – 1,000 ‰. These values are in the range previously observed in CP IDPs, meteoritic organic matter, and organic globules [7-10]. Further analyses are planned to reveal whether these IDPs contain soluble organic compounds that would have been lost by the normal IDP cleaning procedure, including VUV laser organic mass spectrometry [11], XANES spectroscopy, and isotopic measurements by NanoSIMS.

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